Memorandum

To: Eric Blischke and Chip Humphrey, EPA Region 10

From: Lower Willamette Group

CC:

Date: December 9, 2009

Re: QEA Fate Calibration and Sensitivity Analysis Parameters

As requested by EPA, the table below lists several of the key inputs to the chemical fate model (boundary conditions, initial conditions, and parameters) that are currently being considered for calibration and/or sensitivity analysis. During the calibration process, numerous sensitivity runs are typically conducted with the model to isolate the effects of key inputs on the resulting predictions. This is oftentimes a learning process, in which as the calibration process proceeds, different sensitivity runs are developed to test various hypotheses, etc., with the ultimate goal of ending at a robust calibration. As such, it is difficult to list all envisioned sensitivity analyses that would be conducted prior to completing the calibration process (especially since the different classes of chemicals being simulated will likely exhibit varying levels of sensitivity to the different inputs). Likewise, the list of model parameters that are adjusted during calibration can change as more is learned during the modeling process. Nonetheless, the second column in the table below indicates the inputs we currently envision potentially adjusting (within a reasonable range that can be supported by site data and/or literature) during calibration of the chemical fate and transport model.

Beyond the sensitivity analyses conducted as part of the calibration processes (described above) two types of more formal sensitivity analyses will be conducted to demonstrate how key inputs/parameters affect the model:

1. Some inputs will be tested during the calibration process to confirm our working assumption with regard to their relative importance on model predictions. This will help guide how much emphasis needs to be placed on that input (e.g., an input that has little affect on predicted concentrations does not require a large degree of analysis to specify the value used in the model). An example of this might be the Columbia River

downstream boundary condition. In that case, we plan to conduct a sensitivity analysis using an extremely high (and likely unrealistic) concentration at that boundary to evaluate the extent to which it affects the model calibration. Based on that outcome, we will allocate an appropriate level of effort to refining the values used in the model.

2. Other inputs that contain variability and/or uncertainty would be tested using the "final" calibrated model by running it using upper and lower bound values for the input to evaluate how predicted concentrations change. An example of this type of parameter might be storm water loads, where several alternate methods exist, including estimates that represent potential upper and lower bounds on these loads.

Parameters that would be evaluated using these latter two types of sensitivity analysis are indicated in the third column of the table below.

Parameter/input	**Potentially Adjust During Calibration?**	**Conduct Sensitivity Analysis?**	**Notes**
Sediment initial conditions	N	Y	Evaluate method for specifying deep sediment initial conditions (polygons from relatively sparse data set vs. applying scale factor to denser surface data set).
Upstream boundary conditions	?	Y	Unlikely to adjust during calibration, but depends on the robustness of flow-based relationships developed for the full set of modeled chemicals.
Downstream boundary condition	N	Y	Evaluate impact of Columbia River inflow boundary.
Stormwater load calculation method	?	Y	Will attempt calibration first using the composite water, site-weighted average method. Might consider changing to an alternate method during course of calibration.
Storm water load input locations	N	Y	Evaluate single point versus distributed over AFT grid cells.
NPDES discharges	N	Y	Evaluate importance to model by simulating upper bound loads (e.g., permit

Parameter/input	Potentially Adjust During Calibration?	Conduct Sensitivity Analysis?	Notes
			limit).
Groundwater flow rates and plume concentrations	?	Y	Evaluate upper and lower bound values.
Partition coefficients	?	Y	Unlikely to adjust during calibration, but might consider fine-tuning depending on sensitivity results.
Biodegradation rates	Y	Y	Will likely adjust during calibration, depending on sensitivity results
Low flow sediment-water mass transfer coefficient	Y	Y	Consideration will be given to seasonal variation, which has been observed in other systems.
Dispersion coefficient within sediment bed	N	Y	Unlikely to affect model results significantly.
Depth and intensity of bed mixing	Y	Y	Used to represent bioturbation.

Ideally, a subset of inputs to which the model is found to be relatively sensitive would be carried forward during the FS, so that uncertainty on future predictions can be quantified when comparing among potential remedial options.